MPI RESEARCH
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Analytical Report

PFOA and PFOS Analysis of Wild Turkey Serum Samples by LC/MS/MS

MPI Report No. L0019898

Testing Laboratory

MPI Research, Inc.
3058 Research Drive
State College, PA 16801

Requester/Project Manager

Dena Haverland
Dalton Utilities
PO BOX 869
Dalton, GA 30722
Phone: 706-529-1010

1 Introduction

Results are reported for the analysis of turkey serum samples received at MPI Research from Dalton Utilities. The MPI Research study number assigned to the project is L0019898. Table I lists the target analytes quantitated for the samples.

Table I. Target Analytes for Quantitation

Compound Name	Acronym
Perfluorooctanoic Acid	C8 Acid or PFOA
Perfluorooctanesulfonate	C8 Sulfonate or PFOS

2 Sample Receipt

Two samples were received from Dena Haverland at Dalton Utilities for this study. The samples were collected on December 16, 2009. The samples arrived on December 31, 2009 via Fedex and were logged in under MPI Research login number L0019898. The shipment was received frozen on dry ice. The samples were stored frozen at approximately -80°C from receipt until analysis. Chain-of-custody information is presented in Attachment A.

3 Methods - Analytical and Preparatory

3.1 Serum Sample Preparation

3.1.1. Measure 1 mL of serum sample into a 50 mL disposable centrifuge tube and fortify, if appropriate. Add 0.2 mL of a 100 ng/mL WIS for a final concentration of 0.5 ng/mL.

3.1.2 Add water to sample for a final volume of 20 mL. Cap tightly and vortex for ~1 minute.

3.1.3 Transfer 1 mL of the sample using a disposable pipette into 15 mL disposable centrifuge tubes. Add 5 mL of ACN and shake for ~20 minutes on a wrist action shaker.

3.1.4 Centrifuge tubes at ~3000 rpm for ~ 5 minutes. Carefully decant supernatant into a 50 mL disposable centrifuge tube and add 35 mL of water.

3.1.5 Place the unconditioned SPE columns on the vacuum manifold. Condition the SPE columns by passing ~ 10 mL of methanol through the column followed by ~ 5 mL of water. The washes may be pulled through the SPE column using vacuum at a flow rate of ~1 drop/sec or may be allowed to pass through the column unaided. Discard all washes. Do not allow the column to dry.

3.1.6 Load the sample onto a conditioned SPE column . Discard the eluate. Any analyte residues will be trapped on the SPE column at this point.

3.1.7 Elute with 2 mL of methanol. Collect 2 mL of elute into a graduated 15 mL centrifuge tube.

Note: When sample dilution was required, the sample was diluted in control turkey serum prior to extraction.

3.2 Sample Analysis by LC/MS/MS

In High Pressure Liquid Chromatography (HPLC), an aliquot of extract is injected and passed through a liquid-phase chromatographic column. Based on the affinity of the analyte for the stationary phase in the column relative to the liquid mobile phase, the analyte is retained for a characteristic amount of time. Following HPLC separation, mass spectrometry provides a rapid and accurate means for analyzing a wide range of organic compounds. Molecules are ionized, fragmented, and detected. The ions characteristic of the compounds are observed and quantitated against external calibration standards.

An HP1100 system interfaced to an Applied Biosystems API 4000 LC/MS/MS was used to analyze the sample extracts for quantitation. A gradient elution through a Phenomenex Luna 3µ C8(2) Mercury, 20 x 4.0 mm column was used for separation.

The following gradient was performed:

Mobile Phase (A): 2mM Ammonium Acetate in Water
Mobile Phase (B): Methanol

Time	%A	%B
0.0	90	10
0.5	90	10
2.0	10	90
5.0	10	90
5.1	0	100
6.0	0	100
6.1	90	10
10.0	90	10

The following parameters were used for operation of the mass spectrometer:

Parameter	Setting
Ionization Mode	Electrospray
Polarity	Negative
Transitions Monitored	413→369 (PFOA)
	413→219 (PFOA Confirmation)
	499→80 (PFOS)
	499→99 (PFOS Confirmation)
	415→370 (Internal Std. ^{13}C PFOA (m+2))
	503→80 (Internal Std. ^{13}C PFOS (m+4))
Gas Temperature	450°C

4 Analysis by LCMSMS

4.1 Calibration

For the serum sample analysis, a 6-point calibration curve was analyzed throughout the analytical sequence for PFOA and PFOS. The calibration points were prepared at 0.1, 0.2, 0.5, 1.0, 2.0, 5.0 ng/mL (ppb) each containing 1.0 ng/mL ^{13}C-PFOA (m+2) and ^{13}C-PFOS (m+4).

The ratio of the analyte concentration to the IS concentration versus the ratio of the analyte instrument response (area) to the IS response (area) was plotted for each point. Using linear regression with 1/x weighting, the slope, y-intercept and coefficient of determination (r^2) were determined. A calibration curve is acceptable if $r^2 \geq 0.985$.

For the results reported here, calibration criteria were met. The calibration curves are included in the raw data in Attachment C.

4.2 Laboratory Control Spikes

Laboratory control spikes in the analytical set were prepared during each extraction set by adding a known concentration of the analyte to turkey serum controls. Laboratory control spikes are used to assess method accuracy. The laboratory control spikes must show recoveries between 70-130% or the data is rejected. For the results reported here, the laboratory control spikes were within the acceptable range. Laboratory control spike recoveries are given in Attachment B.

4.3 Matrix Spikes

One matrix spike was prepared by adding a known concentration of the target analyte to a sample. Matrix spikes are used to assess method accuracy in the matrix. The matrix spikes should show recoveries between 70-130%. For the results reported here, the matrix spike was within the acceptable range.

Note: Due to the endogenous level of PFOS in the sample, the sample was diluted in control turkey serum prior to the fortification of the 5000 ng/mL spike.

4.4 Laboratory Duplicates

One sample was prepared in duplicate and analyzed. Duplicate results are given along with the sample results in Attachment B.

5 Data Summary

Due to an interfering matrix peak at the 499→80 m/z transition, the 499→99 m/z confirmation transition was used for quantitation. The interfering matrix peak was not present at the 499→99 m/z confirmation transition.

Please see Attachment B for a detailed listing of the analytical results. For the serum samples the results are reported in parts per billion (ng/mL) on an as-received basis.

6 Data/Sample Retention

Samples are disposed of 60 days after the report is issued unless otherwise specified by the project manager. All electronic data is archived on retrievable media and hard copy reports are stored in data folders maintained by MPI Research. Hardcopy data is stored for a minimum of five years. The client will be notified 30 days prior to the disposal of hardcopy data.

7 Attachments

7.1 Attachment A: Chain of Custody

7.2 Attachment B: Analytical Results

7.3 Attachment C: Raw Analytical Data

8 Signatures

Mark Neeley, Research Chemist Associate II — Date: 2-16-10

Robert Zhu, Manager, Analytical — Date: 2/17/10

A

MPI RESEARCH

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Login

Login Group: L0019898

Login #:	20012	Conform COC Sample:	True
Project:	P0005380	Conform COC:	True
Company Name:	Dalton Utilities	Conform Sample:	True
Submitted By:	Dena Haverland	Conform Request:	True
Login Type:	Immediate Receipt of Samples		
Started:	True		
Date Start:	12/31/2009		
Due Date:	01/10/2010		
Login Initiated:	12/31/2009		
Received By:	Kyle, Matt		
Spread Sample:			
Label:			
MPI SD/PI:	Zhu, Xiang		
Project Title/Type:	PFOA AND PFOS ANALYSIS OF TURKEY BLOOD, MUSCLE AND LIVER / ROUTINE		
Login Notes:			

Packages / Containers

Package	Carton	Date / Condition	Shipper / ID	Temp. Control/Temp.	Direction / Handled By
K0022627		Received Date: 12/31/09 11:33 Package & Contents Uncompromised	FEDEX 8694 2057 8384	Dry Ice -79.0	RECEIVED Kyle, Matt

Container #	Gross Weight	pH	Container Type	Preservative	Mfg. Lot	Mfg. ID
C0473186	4.10 g		2 ml clear plst vial	NONE		
C0473187	3.00 g		2 ml clear plst vial	NONE		
C0473188	4.60 g		2 ml clear plst vial	NONE		
C0473189	4.20 g		2 ml clear plst vial	NONE		

Samples

Sample ID	Container	Matrix	System	System Matrix	Sample	Date Sampled	Date Due
L0019898-0001	C0473186	LIQUID	Turkey	Serum	Wild Turkey #2 4yr Male - Serum	12/16/2009	01/10/2010
	C0473187						
L0019898-0002	C0473188	LIQUID	Turkey	Serum	Wild Turkey #5 1yr Male - Serum	12/16/2009	01/10/2010
	C0473189						

Login Reviewed By: _____ Date/Time: 2/11/10 1519.

Sample Submittal

MPI RESEARCH

MPI Research Contact: Daniel Wright

Please fax this form before sending samples.

Please send samples to shipping and receiving:
3048 Research Drive, State College, PA 16801
T: (814) 272-1039 • F: (814) 272-1019

Send Report To:

Company: Dalton Utilities
Address: 1200 VD Parrott JR Parkway, PO Box 869
City, State, ZIP: Dalton, GA 30722-0869
Attention: Dena Haverland
Phone #: 706-529-1010
Fax #: 706-529-1271
Email: dhaverland@dutil.com
Study/Job #:
Signature/Date:
Printed Name:

Turnaround time (TAT) requirements:

Results Due Date: 30 days
Preliminary Results Format: Verbal (Email) Fax
Report Due Date: 30 days

Storage Conditions

Room temperature
Refrigerator
(Freezer)
Ultra Low freezer
Desiccated
Lighting required

Stability (°C/%RH):

Stability time period:

Safety Information

Special handling:
MSDS attached
Controlled substance:
HAZARDS:

Please fill in the diamond HMIS/NFPA (0 4) if appropriate

	Client ID# Description	Lot/ Control #	Amt. Sent/ Weight	# of Bottles	Matrix	Date & Time	Tests Requested
1	Wild Turkey #2 4yr Male - Serum		3ml	2	Turkey	12/16/09 11:15am	PFOA/PFOS
2	Wild Turkey #2 4yr Male - Muscle		408gm	1 bag	Turkey	12/16/09 11:15am	PFOA/PFOS
3	Wild Turkey #2 4yr Male - Liver		131gm	1 bag	Turkey	12/16/09 11:15am	PFOA/PFOS
4	Wild Turkey #5 1yr Male - Serum		4ml	2	Turkey	12/16/09 12:00pm	PFOA/PFOS
5	Wild Turkey #5 1yr Male - Muscle		442gm	1 bag	Turkey	12/16/09 12:00pm	PFOA/PFOS
6	Wild Turkey #5 1yr Male - Liver		82gm	1 bag	Turkey	12/16/09 12:00pm	PFOA/PFOS
7							
8							
9							
10							

PO #:

Notes:

Relinquished by	Date	Time	Received by	Date	Time
Daniel Wright	12/21/09	3:00pm		12/22/09	1133

V0002836 2

Administrative Form

FedEx® US Airbill
Express

FedEx Tracking Number 8694 2057 8384

0200 Recipient's Copy

1 From

Date 12/21/09

Sender's Name Darrell Kavanaugh Phone 706 546-5627

Company USDA Wildlife Services / for Dalton Utilities

Address 200 Phoenix Road Dept./Floor/Suite/Room

City Athens State GA ZIP 30602

2 Your Internal Billing Reference

3 To

Recipient's Name Daniel Wright Phone 814 272-1039

Company MPI Research Labs

Recipient's Address 3043 Research Drive Dept./Floor/Suite/Room

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address

To request a package be held at a specific FedEx location, print FedEx address here.

City State College State PA ZIP 16801

8694 2057 8384

4a Express Package Service *Packages up to 150 lbs.*

- [X] FedEx Priority Overnight — Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations.* Saturday Delivery NOT available.
- [ ] FedEx 2Day — Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

FedEx Envelope rate not available. Minimum charge: One-pound rate.

* To most locations.

4b Express Freight Service *Packages over 150 lbs.*

- [ ] FedEx 1Day Freight* — Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx 2Day Freight — Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx 3Day Freight — Third business day.** Saturday Delivery NOT available.

* Call for Confirmation:

** To most locations.

5 Packaging

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.
- [ ] FedEx Box
- [ ] FedEx Tube
- [X] Other

* Declared value limit $500.

6 Special Handling — Include FedEx address in Section 3.

- [ ] SATURDAY Delivery — Not available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.
- [ ] HOLD Weekday at FedEx Location — Not available for FedEx First Overnight.
- [ ] HOLD Saturday at FedEx Location — Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Does this shipment contain dangerous goods? One box must be checked.

- [X] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [X] Dry Ice — Dry Ice, 9, UN 1845 — 1 x 2.5 kg
- [ ] Cargo Aircraft Only

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging.

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below.

- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

Obtain Recip. Acct. No. [ ]

Total Packages	Total Weight	Total Declared Value†	Credit Card Auth.
1		$ .00	

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Residential Delivery Signature Options If you require a signature, check Direct or Indirect.

- [X] No Signature Required — Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature — Someone at recipient's address may sign for delivery. Fee applies.
- [ ] Indirect Signature — If no one is available at recipient's address, someone at a neighboring address may sign for delivery. Fee applies.

520

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MPI RESEARCH

TEMPORARY SAMPLE STORAGE FORM

To be completed during ExyLIMS Login

Project #: P5195

Login #: L19898

Initials / Date: MK 12/31/09

One form to be completed for each package

Date / Time Received: 12/22/09 1133

Received By: M. Kyl

Shipper: Fed Ex

Shipper Package ID: 8694 2057 8384

Temperature (deg C) / Thermometer ID: -79.0° IN0000448

Temperature Control Method: Dry Ice

Temporary Storage Location: Freezer 32

Condition of sample(s):

✓ Good – Package and contents uncompromised
___ Fair – Package damaged / contents uncompromised
___ Poor – Package and contents compromised

Notes:

B

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Summary of Fluorochemical Residues in Serum Samples

	PFOA Perfluorooctanoic Acid	PFOS Perfluorooctanesulfonate
Sample ID	Analyte Found (ng/mL, ppb)	Analyte Found (ng/mL, ppb)
Wild Turkey # 5 1yr male-serum	33.1	2820
Wild Turkey # 5 1yr male-serum*	33.5	2570
Wild Turkey # 2 4yr male-serum	18.5	2090

*Laboratory Duplicate
ND = Not detected = Response is below the LOD of 1.0 ng/mL (ppb).
NQ = Not quantifiable = Response is between the LOD and the LOQ of 10 ng/mL (ppb).

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Recovery Summary of Fluorochemical Residues in Serum Samples

		PFOA			PFOS		
Sample Description	Amount Spiked (ng/mL)	Amt Found in Sample (ng/mL)	Amount Recovered (ng/mL)	Recovery (%)	Amt Found in Sample (ng/mL)	Amount Recovered (ng/mL)	Recovery (%)
LCS A (Data set 020510A) 10 ng/mL	10	ND	11.1	111	ND	12.1	121
LCS B (Data set 020510A) 50 ng/mL	50	ND	52.1	104	ND	50.4	101
LCS A (Data set 020810A) 5000 ng/mL	5000	N/A	N/A	N/A	ND	6386	128
LCS B (Data set 020810A) 5000 ng/mL	5000	N/A	N/A	N/A	ND	5984	120
Wild Turkey # 5 1yr male-serum (L19898-2 Spk C, 50 ng/mL Lab Spike)	50	33.1	87.5	109	2820	**	**
Wild Turkey # 5 1yr male-serum (L19898-2 Spk C, 5000 ng/mL Lab Spike)	5000	N/A	N/A	N/A	2820	7770	99

ND = Not detected = Response is below the LOD of 1.0 ng/mL.
NQ = Not quantifiable = Response is between the LOD and the LOQ of 10 ng/mL.

** The endogenous level of PFOS in the sample significantly exceeds the spiking level, therefore an accurate recovery cannot be calculated.